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NATURAL HISTORY OF PLUMMERS ISLAND, MARYLAND[1]

XXI. Infestation of the lichen *Parmelia baltimorensis* Gyel. & For. by *Hypogastrura packardi* Folsom (Collembola)

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Lichens, long-lived symbiotic associations of lichenizable fungi and algae, appear to have effective means of resisting attacks by pathogenic microorganisms. This resistance has been attributed, at least in part, to the antibiotic activity of phenolic acids that are secreted extracellularly by many species. Snails and slugs, however, have often been seen feeding on and destroying lichen colonies (Coker, 1967; Peake & James, 1967). The paucity of reports in botanical literature on damage by insects, on the other hand, would seem to imply that lichens are relatively immune to these otherwise destructive pests. The best documented studies, as far as I have determined, are concerned with psocids (Broadhead & Thornton, 1955; Broadhead, 1958; Laundon, 1971) but mites have also been mentioned (Sowter, 1971).

I am now able to report a case history of infestation by an insect of *Parmelia baltimorensis* Gyel. & For. (a close segregate of the pan-temperate *P. caperata* (L.) Ach.), a very common foliose lichen on rocks at Plummers Island. Beginning in August 1970, I noted a small amount of frass on the surface of

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[1] The preceding number in this series was published as a Special Publication of the Washington Biologists' Field Club, 1968, 44 pp. Publication costs of the present number have been defrayed by the Washington Biologists' Field Club to promote its primary objective of research on the fauna and flora of Plummers Island and adjacent areas.

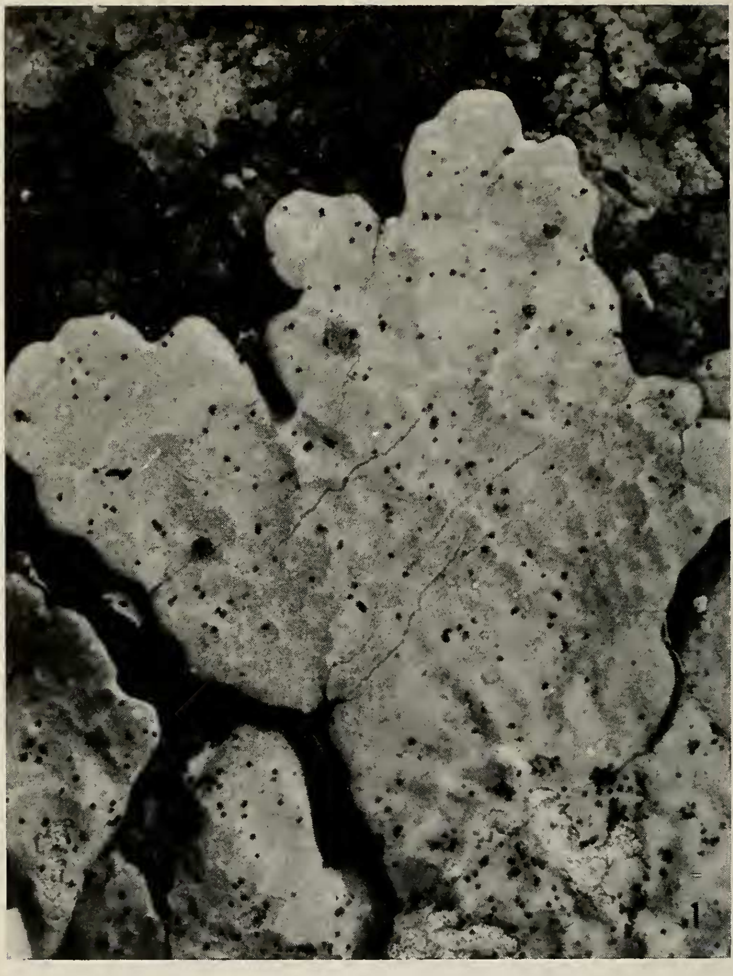

FIG. 1. Close-up of a single lobe of *Parmelia baltimorensis* taken on 13 September 1970, showing frass and initial stage of infestation. Scale as in Fig. 2.

colonies being photographed for growth studies (Hale, 1970) but not significantly more than had been observed in the past. Between late August and early November, however, the upper cortex and most of the algal layer of this species were chewed away completely on specimens covering the rocky

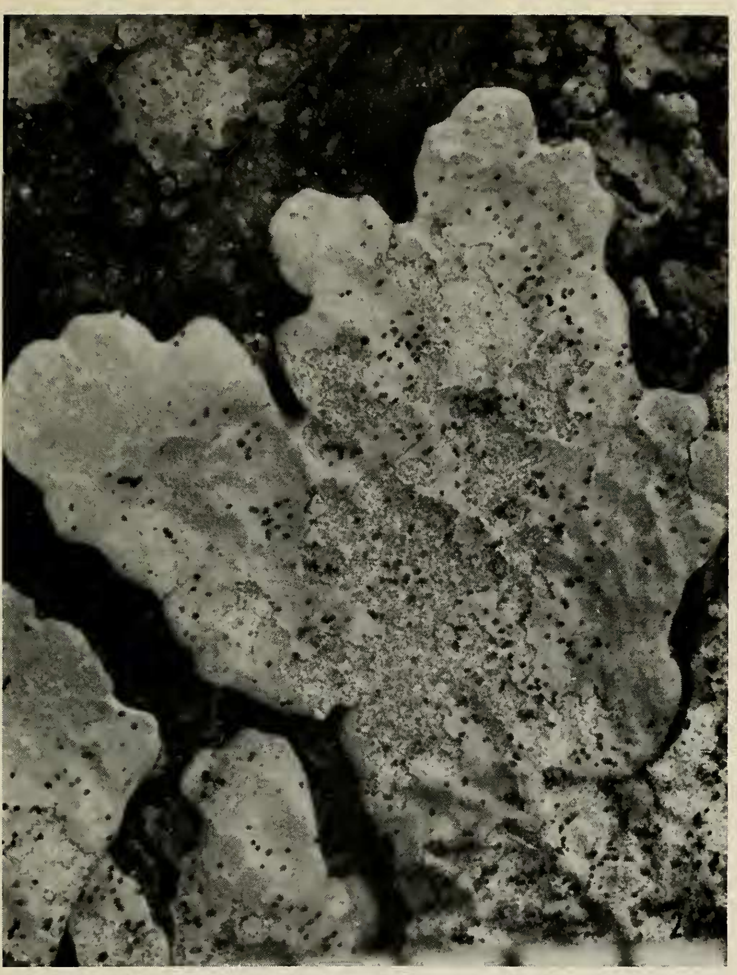

FIG. 2. Close-up of the lobe in Fig. 1 taken on 4 October 1970, showing cortical areas chewed away. Scale at bottom in mm.

ledges west of the cabin (Figs. 1–3). Damage was observed at some distance because the colonies turned dull whitish yellow in contrast to the normal darker greenish yellow.

A thorough inspection of the rocky areas in November showed that thousands of springtails were present just under the turf mat surrounding the lichen-covered rocks (Fig. 4).

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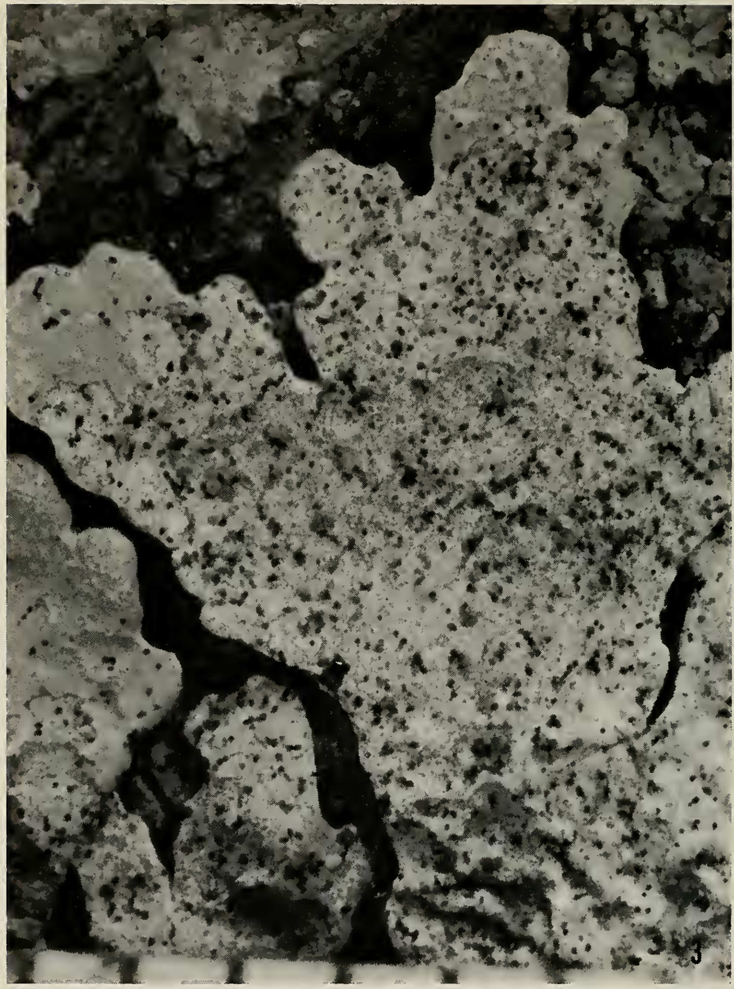


FIG. 3. Close-up of the lobe in Fig. 1 taken on 3 December 1970, showing the lobe surface destroyed except for small areas at the tips. Scale at bottom in mm.

They were not seen feeding during the daytime in the fall but in the following spring (1971) they came out during the day (Figs. 5, 6). Living specimens were brought into the laboratory and reared by Dr. Dale Habeck. They fed on

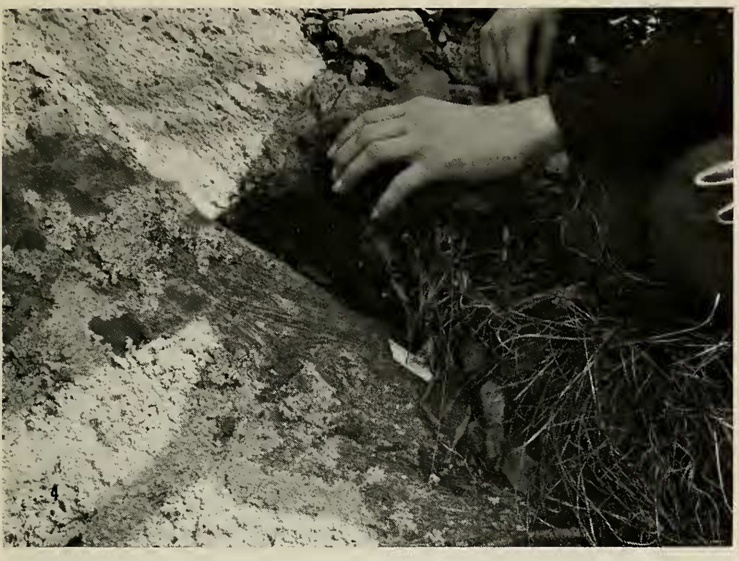
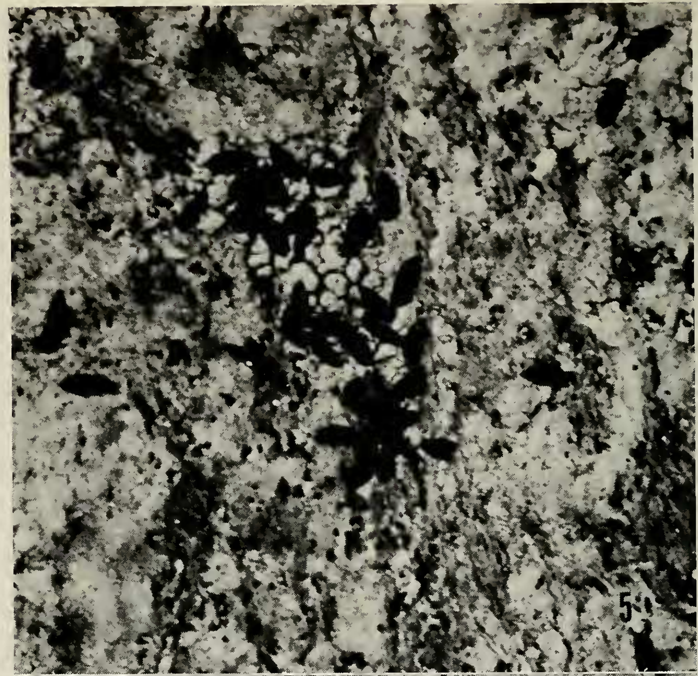


FIG. 4. Turf mat bordering a rock outcrop covered with *Parmelia baltimorensis.*

lichen samples and produced frass identical to that on the lichens in nature, although the frass was so compact and thoroughly digested that no intact algae or hyphae were seen under a microscope. The insect was identified as *Hypogastrura packardi* Folsom, a species that appears to be widespread in eastern United States.

The springtails stopped active feeding by early November 1970 and the lichens were not attacked again during the winter. The insects overwinter in the turf mats bordering the rocks, but emerge on almost any day, even in January at temperatures near freezing. Additional minor damage was done in May 1971 (Fig. 6) but by June the springtails once again retreated to the turf mats and did not attack the plants during the second summer and fall.

The insects fed on the upper cortex and part of the algal layers, leaving the medulla largely untouched. Protocetraric acid, the main acid component of *P. baltimorensis*, occurs abundantly as crystals encrusting the medullary hyphae and may



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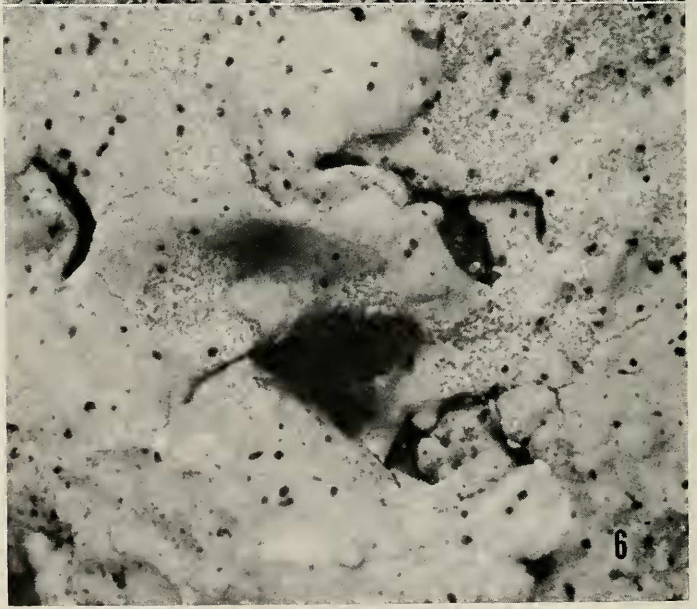

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have discouraged the springtails from eating more of the thallus. In any event large areas in the central part of the lichen colonies soon disintegrated and fell away (Fig. 7). Juvenile thalli disappeared over the winter. In all cases, a band along the lobe margins about 1 mm wide was left untouched. It is noteworthy that as long as the main thallus retained a foothold on the rock the lobe continued nearly normal growth through the summer of 1971. This is good evidence that lateral transport of nutrients across a thallus plays little if any role in lichen metabolism.

Thalli that survived the insect infestation and continued to grow also regenerated the cortical areas that had been chewed away by midsummer. I have no good photographs of this but these new surfaces, though quite rugose, were indistinguishable from unaffected surfaces. The total effect of the infestation, however, was a loss of at least 50% of the lichen colony area covering the rocks.

Why the springtails did such conspicuous damage to this lichen in the fall of 1970 is unknown. The same or nearby quadrats photographed continuously since 1965 had previously shown no comparable damage. The main weather correlation is the lack of rainfall from late August through October 1970. The summer of 1971 was exceptionally wet, and while springtails could be found in the turf mats, no infestation occurred during the wet period from May 1971 through December 1971.

I thank Dr. W. L. Culberson for lists of literature relating to destruction of lichens by animals and David L. Wray for identifying the collembolan.

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FIGS. 5 and 6. 5. Masses of springtails feeding on *Lecanora* sp. in May 1971 (about 10 ×). 6. Single individual of *Hypogastrura packardi* feeding on *Parmelia baltimorensis* (about 20 ×).

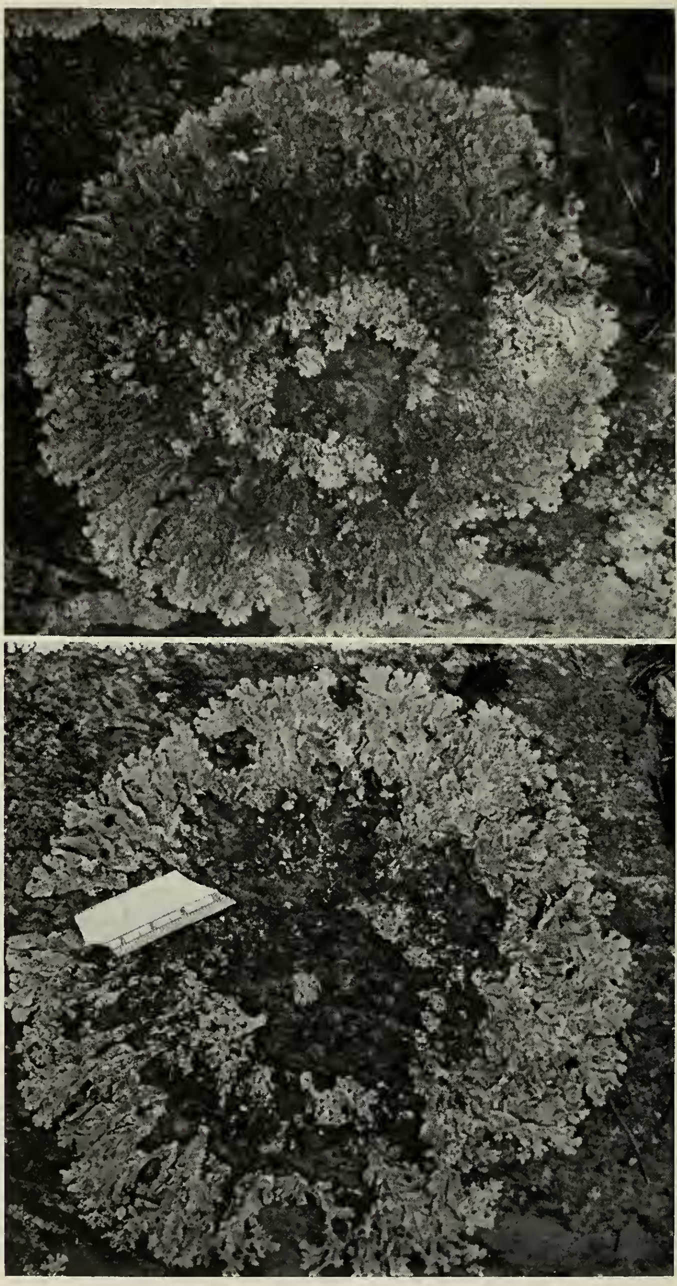

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FIG. 7. Changes in a colony of *Parmelia baltimorensis* over the period 4 October 1970 (top) to 1 May 1971 (bottom). Centimeter ruler in lower photograph.